

Prevalence and Characterisation of Anaemia among Type II Diabetic Female and Male Patients Over 50 Years

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Abstract: *Diabetes mellitus (DM) refers to metabolic imbalance where inadequate insulin release or ineffective insulin activity leads to persistent hyperglycemia. This study designed to evaluate the rate of anaemia among type II diabetics over the age of 50 and to further characterize the condition. Over a duration of ten months, this cross-sectional study was performed in a hospital setting, involving diabetic patients aged over 50 with at least two years since diagnosis chosen according to specific inclusion and exclusion standards. To improve patient's well-being, strategies for routine evaluation and effective treatment of anaemia should focus on individuals with prolonged diabetes duration and those with associated comorbidities or complications. Timely diagnosis and ongoing evaluation of diabetes may contribute to lowering the risk of future complications.*

Keywords: Diabetes Mellitus (DM), Hemoglobin (Hb), Red blood corpuscle (RBC), Mean cell volume (MCV), Mean cell hemoglobin (MCH), Mean cell hemoglobin concentration (MCHC), Erythropoietin (EPO)

1. Introduction

“Anaemia is a reduction in the number of circulating red blood corpuscle (RBC) and/or consequently their oxygen-carrying capacity in an insufficient way to meet the body's physiologic need [1]”. Worldwide, an estimated 1.62 billion individuals are affected by anaemia, representing about 24.8% of the global population [2]. Timely identification and proper management of anaemia can reduce the risk of complications and improve the quality of life in diabetic patients [3].

“Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia as a result of abnormal insulin secretion and insulin action[4]”. “Diabetes mellitus is classified as type I, type II, gestational diabetes, and other specific types caused by factors; such as drugs, chemicals, and disease of the pancreas by American diabetic association (ADA)[5]”. Individuals with DM may develop macrovascular conditions including coronary heart disease, stroke, peripheral arterial disease along with microvascular conditions such as diabetic kidney disease, retinopathy and peripheral neuropathy[6].

“The normal blood mean Hb concentration in adult male is 15.5g/dl (14-18g/dl) and in adult female is 14g/dl (12-15.5g/dl)[7]”. “Grading of anaemia depending upon the level of Hb: Mild anaemia (Hb range from 8-10g/dl), Moderate anaemia (Hb range from 6-8g/dl), Severe anaemia (Hb below 6g/dl)[7]”. “Morphological (wintrobe's) classification based on cell volume (MCV) and mean corpuscular haemoglobin concentration (MCHC) the anaemias can be classified as: Normocytic normochromic anaemia, Microcytic hypochromic anaemia and Macrocytic normochromic anaemia[7]”. “Normocytic normochromic anaemia are

characterised by normal MCV (78-96fL) and normal MCHC (33-37g/dl)[7]”. “Microcytic hypochromic anaemia are characterised by reduced MCV (below 78fL) and reduced MCHC (below 33g/dl)[8]”. “Macrocytic normochromic anaemia is characterised by increased MCV (above 96fL) and normal MCHC concentration (33-37g/dl)[8]”.

Anaemia in diabetic patients may arise from multiple causes, such as persistent inflammation, oxidative damage, autonomic nerve dysfunction, shortage of folate, iron or vitamin B12, autoimmune conditions, drug effects, and increased formation of advanced glycation products[9]. Diabetic individuals have a two-to three-times greater likelihood of developing anaemia compared to those without diabetes[10]. Mounting evidence indicates that the presence of anemia among patients with type I or type II diabetes is strongly and independently associated with an increased likelihood of developing major and minor vascular complications[11]. Thus, the objective of this study was to evaluate the occurrence of anaemia in patients with diabetes.

2. Materials and Methods

In this hospital based cross-sectional investigation, we examined the occurrence and characteristics of anaemia in type II diabetic patients older than 50 years. The study was executed over a period of 10 month at Little Flower Hospital and Research Centre, Angamaly. Individuals above 50 years of age with a confirmed diagnosis of diabetes for at least two years were enrolled according to predefined inclusion and exclusion criteria. Participants were selected using simple random sampling technique, with a calculated sample size of minimum 30 for each group (males and females).

Eligibility criteria included patients aged above 50 years who

had type II diabetes over a period of minimum 2 years. "Patients suffering from renal disease which has diagnosed before diabetes, acute and chronic clotting disorder Hemophilia A (factor VIII deficiency), Hemophilia B (factor IX deficiency) and von Willebrand disease, recent history of surgery, diabetic patients who were critically ill or in coma, anaemia correction treatment such as iron and transfusion therapy in the last three months of data collection, patients suffering from ulcers, bleeding disorders like thrombocytopenic purpura were excluded".

Approval for the study was granted by the institutional ethics board, and all participant information was kept strictly confidential. After getting written informed consent, data will be collected from the patient. Sociodemographic and clinical details will be collected using specially prepared proforma. Proforma will be given to the participants for collecting their personal details including name, age, address, education, occupation. Data regarding history of diabetes, Hb, MCV, MCHC will be collected from patients. The hemoglobin concentration of participants with history of diabetes more than 2 years will be collected. MCV, MCHC values is collected from the subject medical record and analyze it.

The data will be input into a statistical software and analyzed statistically using IBM SPSS (Statistical package for social science) version 22. Baseline parameters were analyzed using descriptive statistics. All quantitative variables are presented as mean $\pm$ SD. All qualitative variables are expressed in terms of frequency and percentages. Kolmogorov Smirnov test is used to assess the normality of data. Chi-square test will be used to analyze association between qualitative variable. It is used to analyze type of anaemia and gender. T test is used for comparisons of gender and Hb concentration.

3. Data Collection

The data collection process was specially designed to ensure precision and accuracy. After receiving ethical committee approval, participants fulfilling the prerequisites were identified, and written informed consent was obtained. A proforma was used to collect data, which included clinical and demographic factors including Hb, MCV, MCH, MCHC as well as demographic variables like age, sex, body weight, height, BMI, smoking history.

4. Results

4.1 Hemoglobin concentration and red blood indices in females

The descriptive statistics of hemoglobin concentration and red blood indices in females are presented in Table 1. The mean hemoglobin concentration was 9.87 with a standard deviation of 1.85, indicating a relatively low hemoglobin concentration. The scores ranged from a minimum of 5.30 to a maximum of 13.60. The MCV was 85.78 with a standard deviation of 7.06, indicating normocytic anemia. The scores ranged from a minimum of 71.50 to a maximum of 97.80. The MCHC was 31.25 with a standard deviation of 1.93, indicating hypochromic anemia. The scores ranged from a minimum of 24.80 to a maximum of 34.00.

Table 1: Hemoglobin concentration and red blood indices in females – Descriptive Statistics

	Female			
	Mean	SD	Minimum	Maximum
Hemoglobin	9.87	1.85	5.3	13.6
Mean cell volume	85.78	7.06	71.5	97.8
Mean cell hemoglobin concentration	31.25	1.93	24.8	34

4.2 Hemoglobin concentration and red blood indices in males

The descriptive statistics of hemoglobin concentration and red blood indices in males are presented in Table 3. The MCHC was 10.99 with a standard deviation of 2.87, indicating a relatively low hemoglobin concentration. The scores ranged from a minimum of 6.50 to a maximum of 17.30. The MCV was 88.34 with a standard deviation of 5.56, indicating normocytic anemia. The scores ranged from a minimum of 77.00 to a maximum of 100.40. The MCHC was 32.58 with a standard deviation of 2.00, indicating hypochromic anemia. The scores ranged from a minimum of 24.60 to a maximum of 37.60.

Table 2: Hemoglobin concentration and red blood indices in males

	Male			
	Mean	SD	Minimum	Maximum
Hemoglobin	10.99	2.87	6.50	17.30
Mean cell volume	88.34	5.56	77.00	100.40
Mean cell hemoglobin concentration	32.58	2.00	24.60	37.30

4.3 Characteristics of anemia in males and females

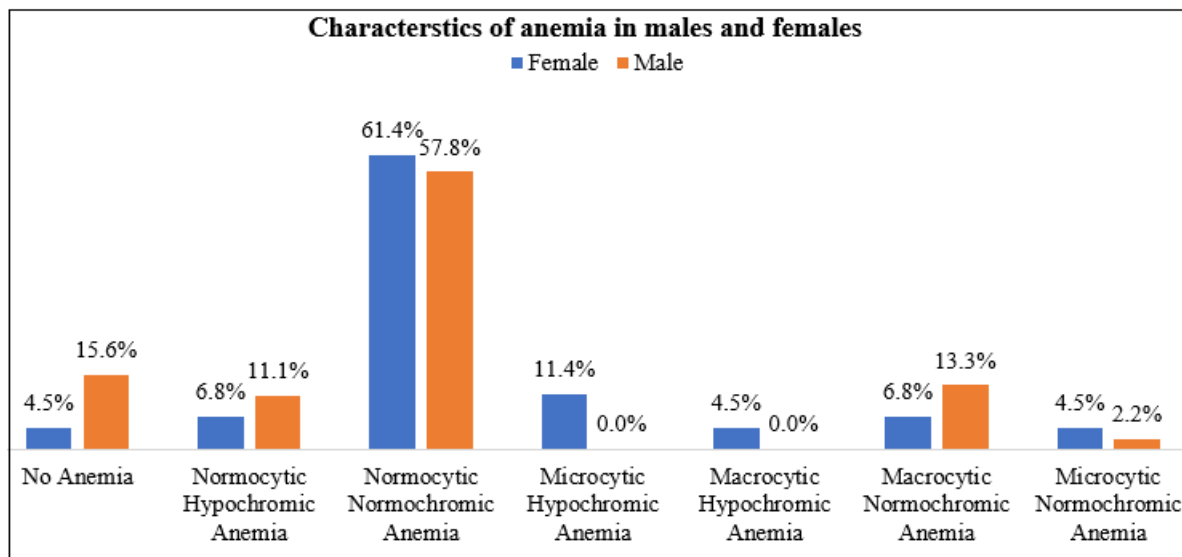
There were a total population of 90 which exhibits diabetes. Table 3 and Figure 1 illustrate the characteristics of anemia in males and females. The majority of females (61.4%) reported normocytic normochromic anemia, with two participants (4.5%) falling into no anemic category. Around 11.5% reported microcytic hypochromic anemia and 6.8% were normocytic hypochromic and macrocytic normochromic anemia. The occurrence of anemia in macrocytic hypochromic anemia and microcytic normochromic anemia were 4.5%. This demonstrates that most women with diabetes perceive anemia though only a small proportion falls into no anemic category.

The majority of males (57.8%) reported normocytic normochromic anemia, with seven participants (15.6%) falling into no anemic category. The occurrence of anemia in macrocytic normochromic anemia were 13.3% and normocytic hypochromic anemia were 11.1%. Around 2.2% were microcytic normochromic anemia. This demonstrates that most men with diabetes perceive anemia though only a small proportion falls into no anemic category.

Overall, the results indicate that proportion of anemia was higher in females than males. Diabetic women are more vulnerable to anemia due to combination of factors including the direct effect of diabetes, lack of nutrition, gender-specific issues and societal health disparities.

Table 3: Characteristics of anemia among females and males

Type of Anemia	Sex			
	Female		Male	
	F	%	F	%
No Anemia	2	4.50%	7	15.60%
Normocytic Hypochromic Anemia	3	6.80%	5	11.10%
Normocytic Normochromic Anemia	27	61.40%	26	57.80%
Microcytic Hypochromic Anemia	5	11.40%	0	0.00%
Macrocytic Hypochromic Anemia	2	4.50%	0	0.00%
Macrocytic Normochromic Anemia	3	6.80%	6	13.30%
Microcytic Normochromic Anemia	2	4.50%	1	2.20%

**Figure 1:** Characteristics of anemia in males and females

4.4 Association between gender and type of anemia

Table 5: Association between gender and type of anemia

Type of Anemia	Sex		χ^2	Df	p-value
	Female	Male			
No Anemia	2	7	11.62	6	0.071
Normocytic Hypochromic Anemia	3	5			
Normocytic Normochromic Anemia	27	26			
Microcytic Hypochromic Anemia	5	0			
Macrocytic Hypochromic Anemia	2	0			
Macrocytic Normochromic Anemia	3	6			
Microcytic Normochromic Anemia	2	1			

The above table shows the cross tabulation between gender and type of anemia. Since the p-value is greater than 0.05, the chi-square test interprets that there is no notable association between gender and type of anemia.

4.5 Comparison of Hb levels between male and female diabetic patients Mean, S.D. and t-value to compare the Hb between Females and Males using t-test

The Mean column in the t test table displays the mean Hb levels in females and males respectively. The standard

deviation column displays the standard deviation of the Hb level in females and males. The difference (1.12) shows the difference between Hb level in females and males (9.87 & 10.99). Since the p-value < 0.05, there is a significant difference in Hb level between males and females. The Hb level in males is significantly high.

Group	Mean	S.D.	Difference in mean	N	t	df	p-value
Female	9.87	1.85	1.12	89	2.19	87	p < 0.05
Male	10.99	2.86					

5. Discussion

This study aimed to evaluate the prevalence of anaemia among type II diabetic patients over 50 years and characterisation of it. The findings highlight most people with diabetes perceive anemia though only small proportion falls into no anemic category.

A substantial proportion of participants with diabetes reported anemia, only a small proportion falls into no anemic category. These results suggest that proportion of anemia was higher in females than males. Diabetic women are more vulnerable to anemia due to combination of factors including the direct effect of diabetes, lack of nutrition, gender-specific issues and societal health disparities. Diabetes damage kidneys over time, a condition known as diabetic nephropathy. Diabetic nephropathy reduces the ability of kidney to produce erythropoietin. Erythropoietin is a hormone that triggers RBC synthesis and supports oxygen delivery to body tissues. Hypoxia is a potent stimulus for

EPO production. Prolonged hyperglycemia can also contribute to oxidative stress and inflammation which shortens the lifespan of red blood cells and suppress erythropoiesis.

Iron deficiency resulting from poor dietary intake makes anaemia highly prevalent among women in India. This preexisting vulnerability means that when a woman develops diabetes, the additional physiological stress makes anemia more severe. Our populations belong to end of reproductive age and beginning of menopause. Males have higher red blood cell (RBC) counts and erythropoietin levels than females, as androgens stimulate erythropoiesis while estrogens inhibit it. After 50 years most women experience menopause. Before menopause estrogen has protective effects on cardiovascular and metabolic health. The drop in estrogen after menopause can worsen insulin resistance, exaggerating diabetes complications that contribute to anemia. Androgens stimulate the production of RBC by increasing erythropoietin production. After menopause, women with diabetes may experience changes in androgen levels contribute low production of RBC compared to men. Women of reproductive age have higher chances to develop iron deficiency anemia due to blood loss during menstruation. Diabetes and anemia share overlapping symptoms like fatigue, paleness, and shortness of breath. This cause anemia to be overlooked or misattributed to diabetes, delaying proper diagnosis and treatment.

There is no notable association between type of anemia and gender mostly. Normocytic normochromic anemia is affected by most of the diabetic people. Normocytic refers to RBC that maintain a normal size, while normochromic indicates that the hemoglobin concentration within these cells is within the normal range. It means that they have a normal red colour and are not pale. Normocytic normochromic blood pictures indicates that a person's red blood cells are normal in size and colour. Microcytic and macrocytic hypochromic anemia is no affected by diabetic males. No anemic were two among females and seven among males. Males are least affected by anemia compared to females.

In summary this study highlights most people with diabetes perceive anemia though only small proportion falls into no anemic category. Diabetic women are more vulnerable to anemia than males. One limitation of this study is that it was conducted in a single hospital, which may restrict the generalizability of the findings to all diabetic patients or those to visiting other healthcare centers. These finding reinforce the diabetic people to take measurements to avoid developing anemia.

6. Conclusion

This study presents significant findings on the prevalence and features of anaemia among individuals over 50 years of age living with type II diabetes. Prevalence of anemia among diabetic women is more than diabetic men. Diabetic women are more vulnerable to anemia due to combination of factors including the direct effect of diabetes, lack of nutrition, gender-specific issues, menopause and societal health disparities.

Developing structured screening and management approaches for anaemia particularly in individuals with long duration diabetes and associated comorbidities or complications can significantly enhance patient quality of life. Prompt identification of diabetes, combined with regular monitoring, can play a key role in limiting subsequent complications.

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